RESEARCH HIGHLIGHT
Basic Sciences Program
Geosciences Subprogram

Project: Organic Anion - Mineral Surfaces

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Objective: The general focus of this project is mineral surface geochemistry. The specific focus is organic acid interactions with mineral surfaces.

Results: Global carbon cycles are linked to long-term climate changes, although the effect of organic activity on silicate weathering is uncertain. Silicate weathering reactions control the movement of carbon between the atmosphere and oceans over geologic time scales. However, the magnitude of the shift from abiotic to organically mediated weathering is unclear. To resolve more precisely the physical, chemical and biotic controls on weathering, a model was built based upon measurements at a single mineralogically and hydraulically similar field site in Hawaii. Digital imaging of basalts resolves the coupling between temperature, rainfall and weathering in the presence or absence of lichens. Activation energies for abiotic dissolution of plagioclase (23.1 ± 2.5 kcal/mol) and olivine (21.3 ± 2.7 kcal/mol) are similar to those measured in the laboratory, and roughly double those measured form samples taken underneath lichen.

Significance: These results show that abiotic weathering rates are proportional to rainfall and that dissolution of plagioclase and olivine underneath lichen is far more sensitive to rainfall (Figure 1).

Publication: A journal article entitled "Direct measurement of the combined effects of lichen, rainfall, and temperature on silicate weathering" has been written by P. V. Brady, R. Dorn, A. Brazel, J. Clark, R. Moore and T. Glidewell and is published in Geochimica Cosmochimica Acta, 19/20, 3293-3300, 1999.

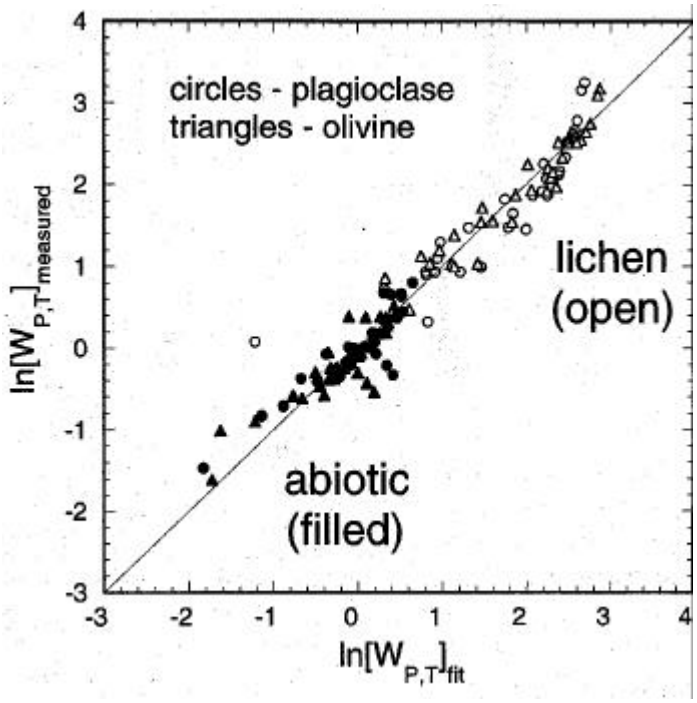

Figure 1. Measured weathering rates and rates predicted from fitting of all of the measurements, with a slope of 1.